

THE LURE OF MEDICAL HISTORY

ESSAYS ON THE HISTORY OF EMBRYOLOGY*

OLD IDEAS REGARDING SEX, FERTILIZATION,
AND PROCREATION

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WE know from the oldest of myths and sagas that even our remotest ancestors were curious about their origin and development. They could not help but be, and when man first began to speculate upon the origin of the universe he could not have failed to speculate also regarding his own origin. Hence, in a certain sense, the history of embryology is contemporaneous with human thought, and, although I do not mean to imply that the habit of systematic observation goes back to the earliest days of man, even primitive man must have begun to think regarding what he saw around himself and what he experienced within himself as soon as he began to think at all.

The history of embryology should be contemporary with that of gross human anatomy, for what could arouse more curiosity than prenatal life or the newborn. There must of necessity have been abundant opportunity for observations upon such things as bird and mammalian embryos in connection with the search for food and the use of eggs for food. In the days when human relations were primitive and life was rude, disembowelings of man and animals cannot have been rare, and fetuses must have been a rather common sight. Moreover, there is reason to believe that the examination of the unborn was then not hedged about by restrictions as was that of the dissection of the dead of any age in postnatal life. The bodies of fetuses born prematurely, unless very near term, usually were not regarded as sacred, as were those that died after a mature birth, an attitude which survives and hampers us even today.

Since the very young embryos of all mammals are so very similar, and since pregnant human beings, as well as animals, were often "put to the sword," opportunity for observations on prenatal development cannot have been lacking even in primitive times. If we recall that man for ages past used the eggs of fowl and the flesh of animals for food, and used human sacrifices, the correctness of this inference will be abundantly evident.

EARLY SPECULATIONS

It is curious that the history of embryology has received so little attention and that no full treatise on it exists in any language. This may be partly due to the fact that the entire history of science was neglected until a very recent date, but the chief explanation probably lies in the relatively recent development of embryology itself. Until we learned how to preserve embryos and

imbed, cut, and stain them and learned to reconstruct them graphically or in paper or wax, progress was very difficult.

When tracing the history of embryologic ideas, one is impressed with the fact that anything approaching a correct view of individual development is a very recent thing indeed. This is partly due to the fact that men preferred to trust their minds rather than their eyes and hands and because speculation was easier than observation from the very beginning. It has always been more convenient to use the subjective than the objective method. Anyone can sit and think upon anything he chooses, anywhere and at any time, without the least inconvenience except that of thinking, but in order to make observations it is necessary to bestir oneself, and experimentation is especially troublesome. Hence, speculations long were numerous but observations few, and John Hunter's advice, "Don't think. Try," long remained unobserved and experimental embryology hence is mainly a child of today.

When one recalls the long era during which human beings have existed upon earth and how brutish the life during much of that period has been, it would be strange, indeed, if someone did not note tens of thousands of years ago that the earlier stages in the development of mammals are very similar. It is difficult, indeed, to understand how some of the very fanciful ideas of man's origin could have appealed to or satisfied anyone.

The oldest conceptions on everything must necessarily remain unknown to us, and it is scarcely possible to realize fully the difficulties presented by such questions as that of sex and procreation to early writers and investigators. The great Haller began the chapter on conception in his justly celebrated work entitled "First Lines of Physiology" by saying, "This is a very arduous investigation, as we propose to discover the changes which take place in the inward parts of woman when a new creature begins to germinate. . . . We shall relate, in the first place, therefore, those things which experience shows to be true; and then to add those hypotheses by which learned men have endeavored to supply such things as are not evident from the subject itself. How few things are ascertained on this subject, and how difficult they are ascertained, I have learned by too much experience." As late as 1775 this great physiologist, in the introduction to his physiology, is said to have declared that nature hides the early beginnings of the new individual behind dense blackness and reveals nothing about the ovum, which she permits to be incubated.† If this was the case in 1775, then

† Although this statement is repeated upon good authority, I was unable to find it in the introduction to the editions of Haller's "Physiology" of 1747, 1751, and 1764. However, I did find a similar expression in the introduction to the Dissertations of Spallanzani, where the latter says, "In times past, I acknowledge that generation, both in animals and plants, was involved in darkness impenetrable to the human eye; but since the appearance of Haller and Bonnet, this gloom has been rendered much less thick." Since Erasmus Darwin in 1801 also says that "The process of generation is still involved in impenetrable obscurity," it is not improbable that this expression may have been handed down from the past.

* From the department of anatomy, Stanford University.

† This paper will be printed in three or more parts. References will be printed with the last article of the series or in the reprints. This is the first paper of the series.



Fig. 1.—The commonest, though probably not the best, likeness of Redi.

how much more it must have been true in the days of Aristotle who, when greatly puzzled about the generation of bees, wisely wrote: "The facts have not yet been sufficiently grasped; if ever they are, then credit must be given to observation rather than to theories, and to theories only if what they affirm agrees with observed facts." It is well for us not to forget that Aristotle based his belief in the origin of fleas from snow, animals from fire, eels from mud, and fishes and insects from various other substances, upon conclusions drawn from observations. According to Aristotle, ". . . Nature passes in an unbroken manner from inanimate things to animals, through forms of life which are not animals, in such a way that one class seems to differ very little from another in the part where they border on each other." Lones, after whom this sentence is quoted, says that this idea was foreshadowed by other Greek philosophers and that the vital principle, which according to Aristotle could generate life out of "earth, mud, sand, foam, or dew" was "related to living bodies" as form to matter, or sight to the eye, and that "if an eye were a living being, then sight would be its vital principle." Aristotle knew the placenta of a shark, which Johannes Mueller rediscovered in 1839, and it need not surprise one that he thought animals had a vegetal and an animal period of existence, the former persisting up to the development of the heart.

It is pertinent to recall here that Bastian, a leading British biologist who, in the middle of the nineteenth century, reached the conclusion that bacteria can arise spontaneously in sterilized solution, did so on the basis of experiment. No wonder that this announcement evoked the ejaculation "Mon Dieu! mais c'est non possible!" from Pasteur during the course of an international congress of biologists, held in London, for Pasteur had finally shown that such a thing was indeed impossible. As is well known now, the difficulty with Bastian's experiments lay in the inadequate sterilization of his solutions.

OLD IDEA OF SPONTANEOUS GENERATION

As is well known, the old idea of spontaneous generation lives on among the laity today. Who has not heard that thread worms arise from the hairs from the manes and tails of horses, which accidentally fell into the watering trough while the animals were drinking. Indeed, many of the laity still hold to the words of Ross, uttered in the seventeenth century in reproach to Sir Thomas Browne's disbelief in spontaneous generation. The former wrote, "So may he doubt whether in cheese and timber worms are generated; or if beetles or wasps in cow's dung; or if butterflies, locusts, grasshoppers, shellfish, snails, eels, and such like be procreated of putrefied matter, which is apt to receive the form of a creature to which it is by formative power disposed. To question this is to question reason, sense, and experience. If he doubts this, let him go to Egypt and there find the fields swarming with mice, begot of mud of the Nilus, to the great calamity of the inhabitants."

In spite of Redi's crucial experiments on the generation of some insects, the idea that animals could arise without parentage lived on long thereafter even among leaders in science such as Redi and Harvey. It was not rejected by "natural philosophers," it seems, until 1715, in which year an English natural philosopher, G. Cheyne, wrote: "Nobody nowadays that understands anything of nature or philosophizing can so much as imagine that any animal, how object soever, can be produced by an equivocal generation or without of male and female parents in the same or in two different animals. . . . I shall have occasion in the following chapter to make it evident that every generated animal is produced from a preëxistent animalcule of the same species, and that every vegetable arises from a small plant of the same kind, and it is impossible, it can be otherwise upon our adversary's scheme of admitting nothing but matter motion; for if animals and vegetables cannot be produced from these (and I have clearly proved they cannot) they must of necessity have been from all Eternity." Redi himself wrote: "Before returning to my argument, I cannot refrain from saying that I do not consider it a great sin against philosophy to maintain that the worms of plants are created by the same natural principle that produces the fruits of the plants. . . ." Redi

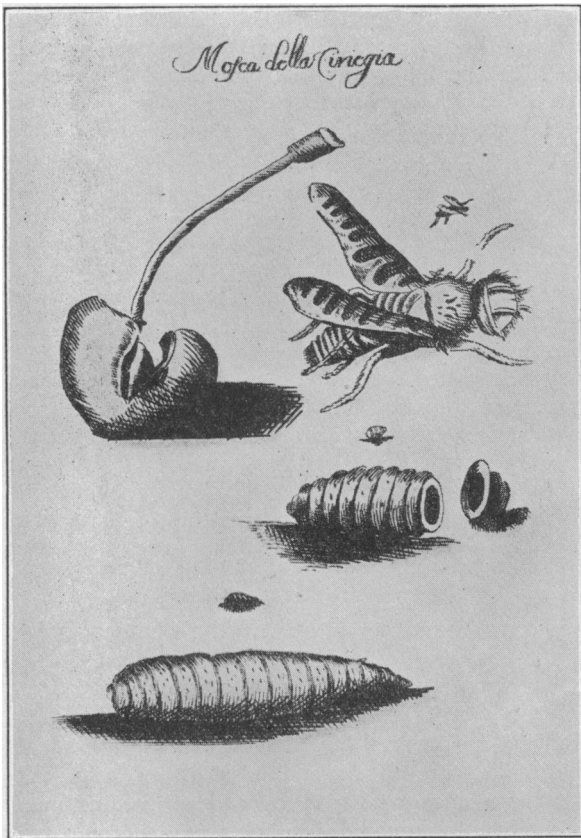


Fig. 2.—A reproduction of an illustration from Redi representing the development of the "cherry fly" as he knew it. Redi could not ascertain or understand how the egg which gave rise to the "worm" could get into the cherry.

could not learn how the eggs of insects could be introduced into fruit, and made the above comment in connection with Fig. 2 here reproduced.

In examining and judging the scientific ideas of older writers it always is necessary to recall the temper of the time in which they lived, the store of accumulated knowledge and the available methods at the disposal of investigators. The great men of the past whose scientific conceptions on sex, pregnancy, and prenatal development often seem so strange to us did not lack intellect, but proven experimental methods and accumulated knowledge. They lacked a scientific background—a store of facts—and were groping in the dark far more than are we of today, regarding some of the very problems which perplexed them. Even we are still largely upon an uncharted sea regarding questions of sex, heredity, etc., and some future age will probably consider our speculations upon these things quite as peculiar as we regard those of our distant forbears. He who fails to consider pioneers in their proper surroundings will hence do them a great injustice. Even Harvey and Redi allowed for the occurrence of equivocal generation because they could not account for all forms of animal life on any other basis even as today it remains undecided whether the bacteriophage is a living or a nonliving agent.

OLDEST RECORDED IDEAS ABOUT PROCREATION

The oldest recorded idea about procreation is that man as well as other animals arose from putrescent material, from excrements, through the agency of ferments and decomposition, and this idea is still contained in the customary funeral services of the Christian church. Saint Paul, writing in Corinthians, said that we had our origin in corruption, and Jonah asserted that the Lord raised him out of corruption. What our early forbears saw happening in dead bodies and in refuse near their habitations or in the fields probably was partly responsible for the idea that life arises in corruption.

The occurrence of worms in manure heaps was attributed to the presence of the vital spirit still contained in "animal residuum" or feces, though it is not at all unlikely that the idea that putrefaction has generative power may have been suggested by the non-aesthetic aspects of mammalian reproduction; by forbidding geographical relationships of some of the reproductive organs of mammals. Although it is not likely that many human beings were fastidious during the early days of civilization, certain forbidding aspects could not escape attention and long before the days of Sir Thomas Browne there must have been those who felt, if not expressed, his repugnance to our "trivial and vulgar form of coition" and shared his wish that human beings might procreate like trees instead.

In the alchemical treatise *Splendor Solis*, by Trismosin, which appeared in 1582, this mystic teacher of Paracelsus, and seeker for the philosopher's stone, still adopted the idea that all life came out of putrefaction, for he wrote: "By way of allegory we take the hen's egg; in this the form of the chicken cannot take shape without the presence and aid of accidental form, which is the intermixture of the red with the white, by virtue of the heat coming from the hatching hen, and although the egg is the hen's material, nevertheless it cannot develop either its real or accidental form otherwise than by putrefaction, which is caused by the influence of the warmth. . . . In the middle of the Yolk there is the Fifth Element, out of which the young chicken bursts and grows. Thus we see in the egg all the elements combined with matter to form a source of perfect nature."

Empedocles it seems spoke of a genus "oviparum arboreum" or egg-bearing tree, and Fabricius, the teacher of Harvey, declared: "Now that the contemplation of the formation of the chick from the egg is of very ample scope, appears from this, that the greater number of animals are produced from ova. Passing by almost all insects and the whole of the less perfect animals, which are obviously produced from eggs, the greater number of the more perfect are also engendered from eggs." And then he goes on to particularize: "All feathered creatures; fishes likewise, with the single exception of the whale tribes;

crustacea, testacea, and all mollusca; among land animals, reptiles, millepeds, and all creeping things; and among quadrupeds, the entire tribe of lizards. . . . "The foetus of animals is engendered in one case from an ovum, in another from the seminal fluid, in a third from putrefaction: whence some creatures are oviparous, others viviparous, and yet others, born of putrefaction or by the spontaneous act of nature, automatically." Nevertheless, Fabricius described the fetal membranes and apparently saw and described the ovarian vesicles later rediscovered by de Graaf and named after the latter.

Anyone who has read Redi will recall that he states that according to Lactantius, the Stoics believed that human beings sprang forth from the earth as mushrooms do in soil which is rich, warm, and moist. The Egyptians, Ethiopians, Phrygians, Phoenicians, and Athenians each claimed to be the ancestors of the human race, and it is recorded that the Athenians wore golden grasshoppers in their hair to show that they themselves arose directly from the soil even as grasshoppers were supposed to do at that time.

Mother earth was at first regarded as a clumsy worker so that the earliest creatures came "hastily and in disorder from her womb," there being many monsters among them. "But at last the great mother, perceiving that such monstrosities were neither good nor likely to endure, and having become more expert in the art of generation, succeeded in producing men and animals according to their species. Democritus bears witness that men first appeared in the form of small worms, which little by little assumed human shape; or, as Anaximander relates, on escaping from the womb of Earth they were enveloped in a kind of rough, spiny skin, not unlike the burr of a chestnut. After a long period of fertility, during which many monstrous and marvelous generations were brought forth, the Earth Mother became at last exhausted and sterile and lost her power of producing men and the larger animals, still she retained enough vigor to bring forth (besides plants that are presumed to be generated spontaneously) certain small creatures such as flies, wasps, spiders, ants, scorpions, and all the other terrestrial and aerial insects, called by the Greeks "entomadzoa" and by the Latins, "insecta animalia." The schools, both ancient and modern, all agree in this, and constantly teach that the Earth has continued to produce these creatures and will produce them so long as she exists. They do not, however, agree as to the manner in which these insects are generated, nor how life is communicated to them; for they say that not only does the Earth possess this occult power, but that it is possessed by all animals living and dead, also by all things produced from the Earth, and finally by those which are about to decay and return to dust."

THE THEORY OF METAMORPHOSIS

The idea that life arises in corruption later became known as that of metamorphosis, and

survived till the middle of the seventeenth century or the time of William Harvey, who wrote: "Whilst the higher animals produced from eggs are perfected by a succession of parts, the lower creatures that arise in this way, or that are formed by metamorphosis, are reproduced at one effort, as it were, and entire." It is surprising that Harvey, who filled so important a place in the history of embryology, also allowed that "imperfect animals" might arise "out of putrescent material, the drying of a moist substance or the moistening of a dry one." It matters not what Harvey meant by imperfect animals, although it may be recalled that he regarded the lion and cock as perfect and that imperfect animals were those that were not known to arise in their final form, directly from an egg, but passed through an intermediate stage or scolex of Aristotle, such as the pupal or larval form. What matters to us is that one of the pioneers in embryology still felt prompted to recognize putrefaction as a possible source of animal life. Although Harvey is usually considered the author of the phrase "omne vivum ex ovo," this phrase has not been found in his writings. However, the idea was dawning there—and that is the important thing—for Harvey declared: "We, however, maintain (and shall take care to show that it is so), that all animals whatsoever, even the viviparous, and man himself not excepted, are produced from ova; that the first conception, from which the foetus proceeds in all, is an ovum of one description or another, as well as the seeds of all kinds of plants. . . . The history of the egg is therefore of the widest scope, inasmuch as it illustrates generation of every description. We shall, therefore, begin by showing where, whence, and how eggs are produced; and then inquire by what mean and order and successive steps the foetus or chick is formed and perfected in and from the egg."

The idea that lay behind the conception of metamorphosis was in a measure the same as that upon which the earlier idea of equivocal or spontaneous generation was based, but according to the older doctrine life could arise only from putrescent material, according to the newer, also from inorganic substances. Since putrescent material is of necessity organic, the idea of the origin of life from the inorganic was an addition which faces us today. In older literature two forms of generation, the univocal and equivocal, are spoken of. Anything generated univocally arose from a thing of the same kind and a creature which arose equivocally was thought to arise spontaneously from quite different substances.

According to Esser, Susruta also was a preformationist and Caraka (or Charaka) is said to have had a similar conception. Vedic writers from 500 B. C. held that the conceptus forms from the union of sperm and blood from coitus during menstruation. In the Garba-Upanishad or Secret Teachings on the Embryo, it is stated that

a nodule appears in one night; a vesicle in seven and a node in a fortnight. This node is said to become attached in one month, the head appearing in two months, the feet in three, the tarsals, abdomen and hips in four, the vertebral column in five, and the nose, eyes and ears in the sixth. The soul was said to enter during the seventh month.

Nothing seems to be known regarding the conceptions upon development from the old Syrian and Egyptian civilizations, but it is well to remember that this does not imply that these people did not concern themselves with these outstanding matters. More definite records of an interest in and some understanding of the problem of ontogenesis seem to be found in the writings of the ancient Greeks, many of whose conceptions fortunately are preserved for us. It is true that Francis Bacon wrote:

"Now, from the systems of the Greeks and their subordinate divisions in particular branches of the sciences during so long a period, scarcely one single experiment can be culled that has a tendency to elevate or assist mankind, and can be fairly set down to the speculations and doctrines of their philosophy. Celsus candidly and wisely confesses as much, when he observes that experiments were first discovered in medicine, and that men afterwards built their philosophical systems upon them, and searched for the assigned causes, instead of the inverse method of discovering and deriving experiments from philosophy and the knowledge of causes; it is not, therefore, wonderful that the Egyptians (who bestowed divinity and sacred honors on the authors of new inventions) should have consecrated more images of brutes than of men, for the brutes by their natural instinct made many discoveries, whilst men derived but few from discussion and the conclusions of reason."

The earliest Greek ideas came from the early philosophers, but their reflections could not form a continuous story, or even roughly approximate the truth, for the actual story of prenatal development is too intricate to be formulated by mere speculation. The important thing for us, however, is the fact that these older people attempted to obtain light on the problem of prenatal development and that speculations upon the subject recur in so many of their writings. Among the problems which they considered were those of the origin and nature of the genetic substances, of the rôle of the sexes in procreation; of the determination and the causes of sex and of the nutrition of the fetus. They also speculated as to which of the organs of the body develops first or plays a guiding rôle. This question once caused a great deal of controversy, and was spoken of as the question of the primacy of the organs. The heart, the liver, and the brain each in turn was regarded as the most important or influential or leading organ in development.

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(To be continued)

CLINICAL NOTES AND CASE REPORTS

SYPHILIS

IN RELATION TO OCCUPATIONAL INJURIES

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TWO recent cases of late lues in our practice presented industrial features which are worth recording. It is well known that old luetics are apt to develop gummata at sites of traumatism. When this occurs as a result of injuries sustained at work the case may be classed as "occupational" until the lesions are eradicated by treatment.

The following two case records are of interest in this connection:

Mr. C. C. (No. 25948), a Mexican carpenter, thirty-nine years old, presented a typical non-ulcerating gumma extending across the left upper orbital margin. There was a similar smaller lesion at the inner end of the right eyebrow which had been present for several months. The former lesion appeared shortly after the patient was injured in that spot by a piece of lumber on which he was working. An abrasion resulted and it never healed, resulting finally in a typical syphiloma. There was no history of syphilis and the only other evidence found was a strongly positive blood Wassermann. Under neoarsphenamin and bismuth the lesions disappeared.

Mr. P. C. (No. 25190), an Italian laborer, thirty years old, presented a typical nonulcerating syphiloma at the right inner canthus. His blood Wassermann was strongly positive. It was impossible to obtain a history or other evidence of syphilis. About two months previously, while cutting wood with a "rip saw" a splinter of wood struck the side of his nose near his eye. The patient pulled out the splinter and there was a little bleeding. The wound never healed and the syphiloma gradually developed. Under neoarsphenamin and bismuth injections it subsided rapidly.

In each of these two cases responsibility was accepted by the insurance carriers and the necessary treatment to *eradicate the lesions only* was authorized.

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A FOUR-BLADED VAGINAL SPECULUM*

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IN cases of great vaginal relaxation a good exposure of the cervix for purposes of examination or treatment can be gained only by means of a four-bladed speculum. An instrument of this type was recently devised by Nelson¹ which appears to be very satisfactory. However, it occurred to me that a special instrument is not necessary for this purpose, and that equally good results can be obtained with an instrument formed by the combination of two Graves' bivalve specula. This can be accomplished very readily as follows:

A Graves' speculum is introduced into the vagina in the usual manner. A second Graves' speculum of the same size or smaller is inserted and snugly adjusted within the first one so that

* From the San Joaquin General Hospital.